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WHAT IS LIFE ON MARS LIKE?

BY EDMUND FERRIER

THAT most Olympian of astronomers, Le Verrier, at a sitting of the French Academy of Sciences, once cast at his critics this scornful phrase: " Sit down, gentlemen. I will express myself in terms that can be understood even by botanists." And not once, but many times, has the modest science of plants and flowers with as much ease and self-confidence been relegated to the furthermost extreme from the giddy speculations as to the origin of worlds that astronomy deals in. But the discussion which is proceeding on the subject of the canals of Mars is calculated to humble the pride of the learned gentlemen who suppose themselves to have made a final conquest of the heavens. The appearance of Mars during the nights of December, 1911, when it burned so brightly in the sky, distinguishing itself clearly among the stars by its yellow color, and the eloquence with which the American astronomer, Professor Lowell, defends his theory as to the canals, have made the question of what is going on on the surface of that planet a subject of important controversy.

The history of the observations is a singular one. In 1877 the Italian astronomer, Schiaparelli, announced that he had discovered on the surface of the planet a network of dark, straight lines which bound together across the continents a number of seas and which could only be immense canals constructed by intelligent beings. Almost at the same time the astronomers Burton and Dreyer, without knowing anything of Schiaparelli's observations, reported a similar discovery. Such a coincidence left scarcely any doubt as to the reality of the facts. Schiaparelli pursued his observations with vigor; a number of astronomers — Christie, Proctor, Lowell, Douglas, Pickering, Flammarion, and others—set themselves to examine Mars continuously. Sectional maps of the surface of the planet were made. The number of canals discovered increased to four hundred and twenty. They were supposed to be seen filling in summer and emptying in winter. Some of them doubled, so as to form two canals parallel to each other. New canals formed; others disappeared temporarily or definitely. These changes of appearance seemed to be connected, at least in part, with the course of the seasons. It was supposed that a mysterious activity ceaselessly modified the surface of the planet and adapted it to the needs of living beings whose intelligence, if we were to judge by their works, must far surpass our own. The old hypothesis of a series of inhabited worlds took a new lease of life.

Professor Lowell has given this view in its latest form. The planet Mars, like the earth, has its two poles covered with ice-caps. It has also continents and seas. The continents are covered with a vegetation which develops during the summer, continually changing their aspect, and sleeps, like our own, during the winter. The canals, according to this theory, have been constructed by giant engineers, with the help of marvelous machines, whose shape we cannot suspect, the water being distributed equably through the cultivable land as on a microscopic scale is done in Egypt. But the water captured by the Martians is drawn from inexhaustible fields of winter snow and polar ice. Led by the canals from the poles toward the equator, it creates throughout its course a rich vegetation. Along its passage leafy forests and flowery prairies spring up; and it is not the canals themselves, but this luxurious vegetation, which appears in the telescope. Where the canals cross oases are formed; these oases, which perhaps include enormous cities, persist when the canals themselves have temporarily disappeared. All the centers of vegetation are bound together in the summertime by canals. No less than 172 of them have been counted. The regions thus fertilized by the water vary in area from 35 to 200 square miles. In the spring they are clad with the brilliant green color of the young shoots of our own plants (W. H. Pickering); the green gradually fades and takes a blue shade toward the summer solstice (Lowell); it passes finally, at the end of the summer, to a gray monotone (W. H. Pickering). Is not this exactly the image of the changes which our earth must present to the observers, if there are any, who live on the planet

Mars? Here the proud astronomer and the humble botanist work together to enchant our imagination.

Unfortunately, however, there are reasons for doubting the substantiality of this brilliant edifice of the scientific imagination. It is easy to calculate the minimum extent that a canal must present in order to be visible to measure its length and thus to have the necessary elements for estimating its surface. Bringing together the results thus obtained, we find that the total surface of the canals represented on the maps of Mars would be larger than that of the planet itself. This is a result sufficiently startling to give us pause; it suggests that the figures designed under the name of canals refer in reality to discontinuous objects which appear to us mixed together only by reason of the inadequate power of our telescopes. In fact, the use of powerful instruments makes all geometrical regularity of the canals disappear. Using the equatorial of twenty-four centimeters and the telescope of Om. 216 of the Flammarion Observatory at Juvisy, M. Antoniadi, Director of the Mars section of the British Astronomical Association, saw the supposed canals spread, scallop, and pink along their borders and break up into all sorts of segments; while two Italian astronomers, Cerulli and Sola, declare that Professor Lowell's canals are, as the English astronomer, E. W. Maunder, had written in 1894, nothing but series of lakes with no regularity in their arrangement. As M. Charles André had put it, they are " instrumental canals " created not by supernatural engineers, but by our telescopes, our imperfect eyesight, and also our imagination.

Most scientific men deny that they allow any interference of imagination in their scientific work. How, then, could so many practised astronomers have allowed themselves to be deceived by appearances? Some curious experiences have here thrown into relief a singular side of our psychology. We bear continuity and disorder only with difficulty. When numerous and similar objects present themselves to our eyes we involuntarily seek to connect them by some regular arrangement. Let your eyes wander over the patterns or the flowers of your wall-paper; the same designs, according to your disposition at the moment, will appear to you grouped in horizontal or vertical or oblique lines which will appear to run parallel or to cross in diverse fashions. Some parts, at least, of the canals of Mars have been created by such a mental operation as this. Maunder and Evans made an experimental proof of the fact. They set some children to draw irregular figures, roughly recalling the spots that one can see on Mars; and some of the young draughtsmen, who knew nothing of the purpose of the experiment, reproduced with astonishing fidelity the most characteristic parts of the geometrical designs of Schiaparelli. Is it not, by the way, this tendency of our mind to arrange everything that the impressionists count upon to complete the hints thrown out in their imperfect paintings?

Does all this mean that there are no inhabitants in the planet Mars? No. Mars is certainly inhabited. The collapse of the fairy world constructed by bold imaginations on the base of the canals of Schiaparelli disposes only of the wonderful engineers of whom Mr. H. G. Wells has given us, in his *War of the Worlds,* such a fantastic and captivating description.

The planet Mars has, in fact, passed through the same phases of evolution as the earth and is still a good deal like it. It is enveloped in an atmosphere similar to ours, but a little less dense and richer in oxygen. Clouds float in this atmosphere, hiding from us details of the surface of the planet. Ice and snow accumulate during winter at the two poles and melt irregularly in the summer, marking by their persistence at certain points regions of high altitude and great mountain masses which rise, as on our earth, at the southern pole. The quantity of ice melted during the summer seems to indicate an average temperature like our own. As with us, clouds formed over the seas break in rains which give birth to fresh-water lakes and to rivers by which the water that evaporation has robbed it of returns to the sea. The density of the planet, which is very little lower than our earth, indicates an almost identical chemical constitution. The conditions which determine the appearance of life on the earth are therefore found on Mars, where they have necessarily produced the same effects.

Living beings of very simple structure, which appeared first and from which all the others are descended, have presented the same characteristics, habits, and aptitudes as on our earth. But the evolution of life on the earth did not take place by accident; the world is regulated by eternal laws which contain in themselves its future, as they have dominated its past. Living beings do not escape from these laws.

Their varied forms are not the effects of accidents; we know that they could not be other than they are, that all that was possible has been realized; we know how the vegetables and animals have been built up; we know the ineluctable causes which have determined the formation of the grand types among which they are divided. These causes have operated on Mars as on the earth. There are algæ and mushrooms, as with us; grasses and trees, flowers, colored and scented, like ours and of like forms. Coral reefs border the continents, whose shores are peopled with worms, starfish, and shellfish; reptiles prowl over the continents; birds pursue butterflies through the air; and mammals people forests and fields. But all these creatures differ from ours in details which may be, to a certain extent, defined.

Mars is more distant than we are from the sun—150 million miles on the average, instead of 100 millions. It is, therefore, a little colder; the more so as its central heat is less, because the diameter of the planet is only 4,500 miles instead of 8,500. Martian days have almost the same duration as ours; but the axis of the planet being more inclined on the plane of the orbit by about four degrees, the polar regions where the sun remains more than one day on or below the horizon are more extended, as is also the torrid zone. The inequality of days and nights at the same latitude is greater on Mars than on the earth; at the latitude of forty-five degrees our shortest day is 8 hours 43 minutes, and the longest 15 hours 38 minutes; these are on Mars, respectively, 7 hours 56 minutes and 17 hours 58 minutes long. The duration of the year is almost double — $668^1/_3$ days instead of 365¼. The orbit of the planet is an elongated ellipse instead of being almost a circle like ours. There is, therefore, more difference between the seasons both in respect of duration and of temperature; and the northern hemisphere, favored by a long summer, is warmer than the southern hemisphere.

On the planet Mars, therefore, there are extreme variations of climate and temperature. Protected by the slowness of the variations of temperature of water, marine animals, fish especially, differ, doubtless, very little from ours; but it is quite otherwise with aerial animals. Those with constant internal temperature have been infinitely more favored on the earth. They must have appeared sooner and have more quickly crushed the great reptiles, which have long been extinct. On the contrary, the plumage of birds and the skin of mammals, which protect these animals against the extreme variations of temperature, must have developed in a luxurious manner, both attaining a splendid variety, changing and being modified profoundly every year with the seasons.

The variations of winter and summer temperature have made even more complete than among ourselves the hibernal disappearance of insects with all its consequences: the sudden metamorphoses of larvæ, the substitution of intelligence for instinct. But the long duration of spring and summer—above all, in the northern hemisphere—has permitted larvæ to attain a more considerable size. The insects of Mars are, therefore, larger and more beautiful than ours. These delicate animals, however, had one means of escaping the rigor of winter—that which ants, bees, wasps have employed, of building habitations where they can live in elaborate societies and accumulate provisions. The long duration of the seasons must have singularly facilitated this work. Mars is, therefore, doubtless more than Hymettus ever was, a land of honey. Probably this world of social insects would provide immense surprises to an earthly entomologist if such an event as that which Mr. Wells has narrated could really occur.

The force of gravitation on Mars is distinctly less intense than on the earth. It has played on our planet a very great part in the evolution of living forms. It has created the dorsal hump in the shell of molluscs, which troubles them so much that they have had to twist it into a screw in order to attenuate it as much as possible; it has also weighed the reptiles down between their limbs and made necessary a powerful muscularity, in order to prevent the different parts of the body from bending one upon the other. Probably, therefore, the moths of Mars are less flat and more agile, the shellfish less twisted, the mammals infinitely more lithe and graceful than ours. A greater number of them have, like our bats, had to dispute with the birds the domain of the air and to prey upon a whole world of magnificent insects. The atmosphere of Mars is the real theater of the struggle for life. Its richness in oxygen permitting a much greater activity of organic combustion, all living beings must be, despite the smaller power of the solar rays, singularly restless; the more so as sunset leads necessarily to atmospheric calm, and consequently to a complete repose. The nights of Mars are, in fact, profoundly dark. Two little stars, Phobos and Deimos, turn around it more quickly than it turns on itself, and pass rapidly across the sky without giving any light. No moonlight, no tides, no lunar month, a complete suppression of that weekly rhythm which on the earth seems to effect so many biological phenomena, and especially the phenomena of reproduction.

It seems impossible that in such a bustling world intelligence has not progressed as among us. If we recall that the terrestrial animals, whose brains are more frequently moved by the repeated excitations caused by the friction or shocks their bodies experience from the surface of the globe, are those in which intelligence has the greatest chance of developing, it is likely that on Mars, as on the earth, the highest organic forms must be beings like our human species. It is improbable that they have acquired wings, for by that they would have had to lose their hands, which are essential organs of control, without which no certain knowledge could have been furnished to them by the other organs of sense.

All this is, perhaps, only a dream, but one cannot reproach biology for trying to complete the evidence of astronomy through reasoning based, like its own, on the constancy of natural laws.

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